REMARKS

Amendments

In the claims, independent claims 1 and 10 have been amended to specify that the center line average roughness R_a is measured using an interferometer. Basis for this is found in the specification on page 10, line 20 to page 11, line 2. Claim 17 has been amended to specify that the base metal foil and the first surface comprise the same metal. Basis for this is found in original claim 19. Claim 20 has been amended to recite that the dendritic structure is densely spaced and fine and that the RD is 1.5 to 1.7. Basis for this is found on page 13, lines 7 to 8 and in Examples 26 and 27.

The Rejection Under 35 USC § 102(b)

Applicants respectfully traverse the rejection of claims 1 to 9 and 17 to 23 under 35 USC § 102(b) as anticipated by Chandler et al. (U.S. Patent No. 5,874,885), insofar as the rejection is applicable to the amended claims.

The present invention is directed to electrical devices in which a conductive polymer element is positioned adjacent at least one metal foil electrode. In one aspect (as recited in claim 1), the first surface of the electrode has a center line average roughness R_a μm as measured by an interferometer and a reflection density RD, such that the product R_a times RD ("R_a*RD") is at least 0.06μm. Devices of the invention can be used in an electrical circuit as circuit protection devices (claim 23). In another aspect (as recited in claim 17), the base metal layer and the first surface comprise the same metal, e.g. copper or nickel. The first surface has protrusions with a maximum height of 1 μm and an RD value of at least 0.6. Such foils have very high surface areas and small nodules. In yet another aspect (as recited in claim 20), the first surface comprises densely spaced, fine, dendritic metal structures. Such foil has a very high surface area, as evidenced by a high RD value of 1.5 to 1.7, and appears dusty.

Both R_a and RD are indications of the surface properties of the metal foil, and the product of these two measurements describes a surface roughness parameter. Devices made using metal foil electrodes having the designated R_a*RD value demonstrate low electrical resistance and low contact resistance, and good resistance stability following thermal cycling or prolonged and repeated electrical stress. Foils meeting the R_a*RD product have a lower surface roughness than those foils previously used, and as such, are less expensive than higher roughness surface foils. In addition, the foils allow faster line speeds during

fabrication and effective lamination at lower temperatures than with conventional foils. Thus the present invention teaches the use of metal foil electrodes having a particular surface roughness, as defined by the R_a*RD product. The R_a*RD product recited in the claims is dependent on the use of an interferometer for determining R_a, as it provides the most accurate measure of a surface which contains small, closed spaced and/or irregularly shaped features.

Chandler et al. discloses the use of metal foil electrodes comprising layers of different metals and having particular surface characteristics, including an R_a value of at least 1.3 (as measured by a Tencor P-2 profilometer) and a RD of at least 0.60. (A comparison of R_a values measured for the foils shown in Chandler to those in the present invention is found in Table II of the present application.) The Examiner contends that Chandler discloses the claimed invention in claim 1 and at column 6, lines 5 to 50, which teaches the specified R_a and RD values. However, the values in Chandler are dependent on the use of a profilometer. (See column 5, line 63 to column 6, line 5 of Chandler, specifying the use of a profilometer and a 5 micron stylus.) Furthermore, there is in Chandler no disclosure of the use of the product of R_a*RD to identify metal foils having low surface roughness characteristics. When the data shown in Chandler are compared to the data from the present application for the same foils, and the R_a*RD product is calculated, it is clear that the Chandler examples have substantially higher values than the limit of 1.6 recited in claim 1.

The table below summarizes the information from Tables I and II of the present application, Table IV of U.S. 6,031,950 (Becker et al; Application No. 09/606,821), incorporated by reference on page 3, line 23 of the present application, and Table II of Chandler).

Foil Name	Identification in Present Application	R_a (Chandler)	R_a (present application)	RD (present application)	R_a*RD
N2PO	V	2.0	4.60	0.93	4.28
Type 31	T	1.6	3.2	0.89	2.85
Type 28	X	1.25	2.7	0.78	2.11

Therefore, Chandler does not disclose the recited R_a*RD product when calculated using measuring techniques specified in the claims.

Considering claims 3 to 5 (reciting specific types of conductive polymer compositions), claims 6 and 7 (reciting the composition of the metal foil), claim 9 (reciting that the device has a resistance of at most 100 ohms), and claim 23 (reciting a circuit comprising a device of the invention), the Examiner contends that all of the elements are

found in Chandler. Even if the Chandler does teach preferred materials for the conductive polymer composition and the foil, preferred values for the device resistance, and the use of the device in a circuit, there is no disclosure of the use of the R_a*RD value as a necessary criteria for the electrode.

Considering claim 17, Chandler specifically teaches that the base layer and the surface layer comprise different metals. This is distinctly different from claim 17, which recites that the base metal foil and the first surface comprise the same metal. Claims 18 and 19, dependent on claim 17, provide additional distinctions over Chandler.

Considering claim 20, and its dependent claims 21 and 22, there is no teaching in Chandler of a densely spaced, fine, dendritic metal structure having a high RD value of 1.5 to 1.7.

The Rejection Under 35 USC § 103(a)

Applicants respectfully traverse the rejection of claim 10 under 35 USC § 103(a) as unpatentable over Chandler et al. (U.S. Patent No. 5,874,885), insofar as the rejection is applicable to the amended claims.

Claim 10 recites that the first electrode has been produced by a process in which material is deposited onto a base metal foil having an R_a of at most 0.45μm to provide protrusions, giving a modified foil having a product R_a*RD of at least 0.14μm. As indicated above, there is no teaching or suggestion in Chandler that it is important that the R_a value be determined by using an interferometer. Therefore, one reading Chandler would not be taught of the features recited in claim 10.

Conclusion

It is believed that this application is now in condition for allowance and such action at an early date is earnestly requested. If, however, there are any outstanding issues which can be usefully discussed by telephone, the Examiner is asked to call the undersigned.

Respectfully submitted,

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